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ABSTRACT

This paper explores what it means, and what it might mean, to "achieve" in literacy. The paper points out that, although there is considerable concern over the misrepresentation of literate achievement by standardized tests, there has been substantially less demonstration of what is being left out, that is, exactly what of significance is achieved beyond the standardized test. The paper uses as an example one that primarily involves what might be classified as science; science was chosen to emphasize the broader issues of literate thinking. It draws attention to the epistemological, scientific, and social aspects that students are learning. According to the paper, students in this fourth-grade classroom sustained conversations relating to books, science, spelling, or math for up to an hour and a quarter at a time, sometimes picking them up again over a period of days, and with relatively limited contributions by the teacher. Illustrations of classroom interactions in the paper show several literate achievements: (1) a particular epistemological frame has been established, one which appears to be developmentally ahead of its time; (2) the understandings that might be called "scientific literacy" are also developmentally advanced; and (3) the social side of the literate practices of these children is distinctive and has significance for their participation in democratic living. Contains 50 references. (NKA)

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PETER JOHNSTON

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UNPACKING LITERATE "ACHIEVEMENT"

PETER JOHNSTON

It is currently popular to argue that schools should be held accountable for student achievement, particularly literate achievement. It is also popular among researchers to study factors that affect student achievement. But what does it mean to "achieve" in literacy? Or what might it mean? It is easy for those outside the classroom to reduce achievement to scores on a standardized test, but there is evidence that this practice trivializes the learning that takes place (Murphy, 1998). It is like assessing "health" by examining the speed with which a person runs a mile, ignoring the complex personal, social, emotional, and political learnings that contribute to the result. The same is certainly true for something as pervasive and consequential as literacy achievement. In this paper, then, I will explore what it means, and might mean, to achieve in literacy. Although there is considerable concern over the misrepresentation of literate achievement by standardized tests (Johnston, 1992; Murphy, 1998), there has been substantially less demonstration of what is being left out, that is, exactly what of significance is achieved beyond the standardized test. This becomes particularly important when pressures are applied to teachers through tests because under such circumstances the unmeasured become excluded from instruction (Johnston, 1998; Smith, 1991).

My current interest in these matters has been piqued by my involvement in a study of exemplary teachers. Our experience is that two exemplary teachers can be very different in the ways they go about teaching. There are similarities, certainly, as many studies attest (Haberman, 1995; Pressley, Rankin, & Yokio, 1996; Thomas & Barksdale-Ladd, 1995), but there are very real differences that doubtless have consequences for students' literate learning. For example, I have often noticed in classrooms and tutoring programs such as Reading Recovery how teachers must tread a careful line between the pace of instruction for immediate efficiency, and the wait-time necessary to develop reflection and self-correction. It might not be the case that there are always trade-offs, but we must know the potential trade-offs in order to make reasoned judgments.

Consider this example. Terri Thorkildson (1998) asked children in a Direct Instruction-oriented school and an inquiry-oriented school about their theories on the fairness of testing practices. The premises of these two approaches to education more or less line up with monological and dialogical patterns of talk. The children in the Direct Instruction school felt that tests were a good and fair way to find out about students' understanding and, indeed, to motivate children to learn – they could see little other reason to learn. They didn't like the idea of time spent on discussion because then, for example, "you might give someone else the answer." By contrast, the children in the inquiry-oriented school felt that tests would not be a good idea, not least because they would take time away from discussion, which they valued as a good source of learning. Which set of understandings would we prefer if these two groups scored equally on standardized tests? What if they did not score equally? How important is children's understanding of what it means to learn and the significance of other people in the process?

Candidates for Literate Achievement

When my youngest daughter was in kindergarten she was occupied one night writing a letter to a boy. It read (with conventionalized spelling) "Dear Gavin. I hope your birthday was fun. Do you know that my birthday is coming up? Love Sam." What struck me was that although she had limited control of the conventions of spelling, she had considerable control of some of the other relevant social conventions, such as her attention to the social niceties of her audience's interests before introducing her own (perhaps especially with a boy). But more important, because the letter spread to both sides of the page, she had written along the side "Turn over," commenting as she did so that he might not know it was continued on the other side. I consider her ability to imagine someone else's experience and use that to regulate literate practices in this way an important achievement. I say this not merely because it happened when she was writing, but because it is a central aspect of literate competence – whether or not it is being exercised in the immediate context of print. It is this competence that enables her to construct believable characters, write plausible dialogue, anticipate necessary arguments for persuasion, etc. Although it is clearly a literate competence, and she is demonstrating it in kindergarten, according to some views of development, this ability to take a distant other's point of view would be a "developmentally

inappropriate" addition to a kindergarten curriculum. I have certainly not seen a "social imagination" on any curriculum documents, although increasingly it seems to me not only appropriate but a central component of development (Dyson, 1993; Johnston, 1993).

Over the years I have also been surprised by the complexity of logic and syntax used by children, sometimes on paper, to persuade – in the case of my own children, usually to address the unsatisfactory nature of our house rules (See also Newkirk, 1989). Similarly, I have been struck by the complexity of philosophical thought children can demonstrate in spite of developmental theories suggesting those thoughts should not be happening (See, for example, Matthews, 1984). These, too, do not appear in curriculum or standards documents. If we have no place for such matters in our theories of development, our notions of literacy, or our curricula or standards for achievement, then teachers and parents will also be less likely to engage children in ways that will foster such development. These achievements would then be excluded from the curriculum simply because we lack the necessary theories, research strategies or imagination – deficiencies that we will likely pass on to our children.

When considering literate achievement, I do not wish to exclude children's command of print conventions – spelling, word recognition, etc. Rather, I want to argue that these capture only a limited portion of literate competence. In this paper, without denying the significance of those achievements we attempt to measure with tests, I will describe some of the dimensions of literate achievement that are left out, and make an argument for including them in what counts. Some of what I describe will possibly draw a reaction of "That's not literacy." When we divide up the curriculum into pieces – science, social studies, reading, writing, math, etc., – some of what I describe will be in gray areas and some will simply not appear. Indeed, these are exactly the aspects of learning that are squeezed out of the classroom in the press to name and secure "outcomes," particularly high profile ones (Johnston, 1998). Because literacy is pervasive across the curriculum, it is particularly vulnerable to these exclusions: What part of science is literate? Is the logic of scientific argument only a literate matter when it is written down? Is talk about historical records part of literacy?

Some resistance to what I will call "literate achievement" will arise from the belief that if it is to count as literate, it must immediately involve the act of reading or writing. Such an argument holds that talking about a book one has read might count as literate, but talking with someone

about a book they have read, or about a book one heard read on a tape, would not count as literate. I will argue instead, along with Applebee (1996), Heath (1990), Gee (1996), Wells and Chang-Wells (1992) and others, that in a literate society the distinction between oral and written discourse is not particularly helpful. In a literate society children must learn ways of representing and interacting. These ways are reciprocally influenced by print.

The notion of what it means to be literate in English has changed substantially over the past few decades, and remains a matter of contention. In the United States the "basic" view of literacy is still popular, which argues for a definition tied to making sounds out of print (Sweet, 1997); whatever else is acquired in the process is not to do with literacy, though its proponents do not name this remainder. Contrasting views explore more subtle and elaborate understandings. For example, literate thinking has come to mean "all those uses of language in which its symbolic potential is deliberately exploited as . . . an intentionally controlled tool for thinking and feeling" (Wells & Chang-Wells, 1992, p.77). In this framework literate achievement constitutes a matter of intellectual development rather than merely expansion of communicative or translation skills. The distinction is not trivial. If literacy is viewed this way, it becomes a tool for building conscious control over learning and for developing independence. It makes possible a critical and reflective stance toward knowledge, knowledge development, and the language used to represent knowledge.

Whether or not this is accomplished is a matter of the instructional interactions in the classroom. Following Vygotsky (1978) and others (Gee, 1996; Langer, 1995; Rogoff & Toma, 1997), I assume that the literate interactions in which children participate are not simply a vehicle for learning, but also a major part of what they learn. Consequently, these must count as literate achievements with implications both for individual students and for the literate communities of which they are a part. On a simple level, then, when a teacher engages students' talk in particular ways, using particular terms, she is specifying the nature of the talk that should take place in the particular discipline – the register, the genre, the word choices. For example, beginning in early adolescence there is a shift in language acquisition toward an expanded Greco-Latin vocabulary – the vocabulary that marks "academic" literacy. Part of literate achievement, then, is revealed in the facility with which children use "academic" vocabulary and discourse forms, whether or not in the immediate context of print.

The way in which the teacher engages students in talk also specifies transparent, yet powerful literate dimensions. For example, in learning science in school, children learn what counts as science, who does it, who asks the questions, what counts as an acceptable question, the acceptable sources of evidence, and what it means to know and not know. These understandings are brought to bear on their sense-making engagements with print, just as they are with their spoken engagements. Children learn these subtleties in the tacit (and related) ways they learn about femininity and masculinity (Gilbert, 1989; Malinowitz, 1995), as unstated presuppositions. Because they are unstated, they are transparent and hard to contest (Todorov, 1996), yet they provide the infrastructure of literate development.

To learn that one has nothing of significance to say is certainly an understanding that will be part literate interactions even though it might have been acquired in oral engagements. What do we make of a fourth-grade student who, when asked if there are different kinds of readers in his class, says, "There's ones like the people who's not good and the people who are good"? When asked if he likes to contribute to discussions of books he says, "Not really. 'Cause I think what Mrs. Wilson does is right. She sort of starts off easy and then she gets real hard with the questions." Asked whether he ever disagrees with the other students in discussions he observes, "No. 'Cause they usually be right." His literacy instruction appears to have produced achievements that should give us pause. First, he is not becoming prepared to participate productively in a democratic society – a society based on the premise of collaborative development of visions to guide social action. Second, rather than learning a self-extending system of knowledge development in which he uses literate conversations to extend his own thinking, he appears to have learned a self-limiting system. He has certainly achieved an understanding of himself as a literate knower that will not serve him well in the long run. There are two interrelated aspects of this that I would like to explore, the epistemological and the social.

EPISTEMOLOGY

Epistemology is from the Greek words *episteme* (knowledge), and *logos* (discourse). Simply stated, a person's epistemology is his or her theory of knowledge and knowing, which on the face

of it sounds esoteric and innocuous. But Parker Palmer (1993) puts his pen nicely on the epistemological problem. He observes:

> At its deepest reaches, education gave me an identity as a knower. It answered the question 'Who am I?' [but, it also answered the question] 'what is the world?'. . . and the same knowledge that gave me a picture of myself and the world also defined the relation of the two. . . . What is the nature of the knower? What is the nature of the known? And what is the nature of the relations between the two? (p. 20)

These are all questions of identity and relationship, but they are also achievements that are fundamental to literacy.

Though there are several ways of classifying epistemological stances, a common distinction is between *constructed* and *received* knowing (Belenky, Clinchy, Goldberger, & Tarule, 1986). I will caricature this dichotomy somewhat to sharpen the distinctions in the interests of space, and because it relates readily to Nystrand and his colleagues' (Nystrand, Gamoran, Kachur, & Prendergast, 1997) distinction between monologic and dialogic instruction. Received knowers feel that knowledge is "out there" and that someone in authority will be able to give them the knowledge they need to receive. Knowledge comes in facts, and clear transmission of these facts is the central part of learning. Received knowers are uncomfortable with ambiguity, expecting things to be right or wrong, and they do not see discussion as a useful means of learning. Their own experiences and feelings are not part of real knowledge and are kept separate from their literate learning. They are not in a position to make knowledge. The ubiquitous IRE (initiate-respond-evaluate) classroom interaction format is very conducive to a theory of received knowing, and very comfortable for a received knower.

Constructed knowers value conversations as a means of learning, particularly conversations in which people share not quite fully formed ideas in the process of collaboratively constructing meaning. They expect, and value multiple perspectives. They are comfortable with ambiguity and feel a moral responsibility for the knowledge they construct; thus they are obliged to adopt a critical stance toward information sources. These characteristics mean that they keep issues open longer and are likely to be less judgmental. They view their own and others' experiences as important sources of information, among others.

As a simple example to ponder, Ellen Adams (1995) documents an exchange that took place while she read aloud to her second graders from *Pompei, Buried Alive*. She makes a connection

with an earlier book, noting that Pompei was in Greece. One of her more capable readers interjects, "Uh . . . I don't mean to tell you how to teach or anything but I remember my father saying that Vesuvius was in Italy." She immediately concedes her error and tacitly apologizes, saying that she should have known that Vesuvius is in Italy. The student responds, "Well, you can't know everything."

But one of the less able readers in the class asks, puzzled, "Aren't teachers supposed to know everything?"

"No," she says, "but I try learning something new each day."

To this a third student adds, "Wow, you must know a lot Mrs. Adams. I mean you're old." (Summarized from Adams, 1995, pp. 137-8).

This last observation aside, the two other students (more and less able readers) appear to have very different understandings about knowledge and its sources and about themselves as knowers.

Knowing always entails a relationship between the knower and the known. In most classrooms this relationship is distancing, controlling, and dualistic. Reality is presented as separate from us, to be known through the teacher or textbook. In science instruction, the "objects" of our attention are routinely presented as separate from us, the scientist's role being to maintain the distance (and height) necessary for an "objective" view. Children are "gently disciplined" (Foucault, 1977) to split their inner feelings and intuitions from their outer world – feeling from "reality," and knowing from morality and ethics. The tool used to pry them apart is language. The careful separation of knowledge and experience is particularly marked for those in special education, in lower reading groups, and for those from lower socio-economic backgrounds (Anyon, 1981; Bryson, 1993; Page, 1991). These students often carefully maintain a separation between texts or school knowledge and life experience, ultimately in spite of teachers' efforts to heal the split (Jones, 1991). As Palmer (1993, p. 21) points out, over time "our epistemology is quietly transformed into our ethic, [forming] the values by which we live our lives."

In other words, there are more of less desirable theories about knowledge that are quietly achieved through literacy instruction in relation to literature, science, social studies, and any other domain. The classrooms my colleagues and I have been studying recently have been selected in part because they integrate various parts of the curriculum, so consider for a moment science as a venue for developing children's epistemology. The word *science* is from the Latin word for

knowledge, or *to know*. Until relatively recently school science was presented as the acquisition of facts that had been verified by scientific procedures and authorized by scientists – a received knowing stance consistent, too, with reading and literature instruction (Cazden, 1988; Dillon, 1988; Nystrand et al., 1997). A clear depiction of this is provided by Driver and her colleagues (Driver, Leach, Millar, & Scott, 1996, p. 125) in the following interchange between students and an interviewer. The students have read about the controversy surrounding continental drift theory, and the significance of a theoretical mechanism for resolving the controversy. In the interview, however, on no occasion do they refer to the mechanism. Notice what they do refer to:

I	So do you think the theory that the continents were once stuck together is sensible?'
S	Yes.
S	Yes.
I	Why?
S	Because we know. Because we have that Wegener bloke . . .
S	So many textbooks have said that this is right.

Current views on science curriculum suggest encouraging a different stance. For example, the National Research Council (1996, p. 105) National Science Education Standards stresses the need for "an appreciation of 'how we know' what we know in science." In other words the idea is to help children develop a productive epistemology into which literacy can be infused. And, as I have already noted, epistemologies entail *relationships* with other knowers as well as with knowledge and the process of knowing. These relationships are also fused to the epistemology.

Consider the current nature of these relationships. The monologue of the average eighth-grade English classroom in the United States is enlivened by 50 seconds of dialogue a day, a figure that drops to 15 seconds in ninth grade (Nystrand et al., 1997). This unidirectional relationship has often been documented in elementary school too, in the ubiquitous "IRE" interaction pattern (Dillon, 1988). This pattern, in which the teacher Initiates, usually with a question, a child Responds, and the teacher Evaluates the response, results in students often looking at the teacher even when their peers are speaking (Cazden, 1988). Not only is the general pattern of interaction singularly monologic, but it is singularly solitary. In science classes, for example, U.S. students are rarely encouraged by their teacher to interact with the ideas of other students. Tsuchida and Lewis (1996, cited in Rogoff & Toma, 1997) found that teachers encouraged children to elaborate

on each other's ideas in only seven percent of lessons, and to express either agreement or disagreement, each in only three percent of lessons. By contrast, in Japanese classrooms the figures were 40 percent (elaborate), 20 percent (agree), and 40 percent (disagree). Even when U.S. students worked in groups, which they do less frequently than Japanese students, they tended to work as individuals without sharing ideas rather than working as a group. In a similar contrast, Toma (cited in Rogoff & Toma, 1997) found that in discussions the proportion of student utterances addressing other students' comments was 81 percent in her Japanese sample and less than 12 percent in her U.S. sample. These literate relationships are an integral part of the literacy students learn and take into their adult lives in a democracy and whatever occupations (senators, members of congress, teachers, researchers) they choose.

An Example for Speculation

For this past year, my colleagues and I have been studying classrooms that were selected in part because they were led by exemplary teachers, and in part because the teachers integrated their instruction in various ways across language arts and some of the other disciplines. Although "integration" was variously defined, with disciplines still often marked off by language and scheduling, literate language and practices were inseparably distributed throughout. The following example is one that primarily involves a topic that might be classified as science. Although I could have drawn more from literature discussions, I have chosen science to emphasize the broader issues of literate thinking. I will draw your attention to the epistemological, scientific, and social aspects that students are learning.

What struck me about this fourth-grade classroom at the outset was that the students sustained conversations relating to books, science, spelling, or math (these were not always easily distinguishable), for up to an hour and a quarter at a time, sometimes picking them up again over a period of days, and with relatively limited contributions by the teacher. An example of this was when some ducklings were hatched in the classroom incubator. The children, having documented the changes in the eggs on charts and graphs, were constantly interested in the hatchlings, of which there were three by the time this particular discussion occurred. Joan, the teacher, opened the discussion with "I'm going to be writing questions as I hear people talking and I expect you

will too. I haven't worked with ducks before so I'll have a lot of questions." The students have observed the younger duckling being pecked by the other ducklings and, unprompted, they begin to generate theories to explain it. Shirley fairly quickly introduces the idea of a pecking order. Chase suggests they peck each other because it's "like teething rings for babies." Alex's explanation is that it's like older siblings. Jack returns to Chase's idea that babies put everything in their mouths and mothers complain, "You don't know where that's been."

Shirley elaborates her pecking order theory, noting that "The weaker and sicker ducks get pecked on." Jack disagrees. He thinks the other ducks know the duckling is younger, just like they once were, implying that the older ducks would take that into account and give the younger one a break. Gordon agrees.

Laura adds, "I disagree with Shirley because [evidence] and I agree with Jack and Gordon because [observation], and . . . [observation] . . . So . . . [hypothesis] . . . because . . . [observation] . . . But . . . [observation]."

Joan suggests that "what scientists do when they have questions is to experiment."

The discussion is picked up again with the birth of a fourth duckling and the students decide to experiment to see what will happen. Joan asks that everyone should "be writing what they think will happen." She then invites them to share what they have written, beginning with a weaker student, Lane. The students then call on each other to comment and add their own proposals. Joan takes a brief poll and finds the students are divided.

Joan summarizes a comment by Clem both for confirmation and to make sure it is heard by all. She adds "I hear you, and others, talking about *time*." She connects this to the science teacher's discussion of "variables," then connects it to the suggestion yesterday that it might be territorial behavior. She then brings up Art's question about *what* would happen *if* the tank were larger, a question that suggests an active attempt to explore covariance in the ecological system, with the goal of choosing between theories.

Aja suggests another possibility, that it is like a gang, and "if you're strong enough you can be part of the gang and they make fun of the geeky girls."

Joan puts the ducklings in the tank and the children giggle with excitement, commenting, "They're scared."

Joan asks, "Is that an observation?" prompting them to distinguish data from theory. She adds, "Jessie's writing down what she thinks, so she won't forget it." This writing promotes reflection. There is lots of conversation and commentary.

The ducklings continue to occasionally peck one another. Clem proposes a new hypothesis – that it is like monkeys' grooming behavior, suggesting that maybe it's not aggressive. The conversation continues and includes:

"All the ducklings did it at the beginning," (a new observation on covariation).

"Maybe it's not that bad – you just don't know," Jake says, following up on Clem's suggestion and keeping the taken-for-granted open for examination.

"Maybe they like to peck, and they are bored with pecking the food," following up on the "teething ring" proposal.

The next day, the following exchange occurs:

Joan: So my question to people at the farm would be what would happen to this duck in the wild?

Jack: Well the mother's there so really . . . and they're all brothers and sisters, so I doubt they'd do what they're doing now when they're out in the open so they have more room to run around and more things to explore and peck at.

Laurel: //Oh, oh…

Joan: I notice Laurel that when he was talking it sort of jogged your mind – what were you thinking?

Laurel: Maybe they're territorial. Like, that brown one's sitting there right now. He was sitting there and that one started pecking him, so, like, maybe they're territorial.

Sasha: What do you mean?

Laurel: Like they don't want to share their property. Sort of like a farmer… Oh, like, what's that show? [describes a movie]

Aja: *That Darn Cat* ……

Aja adds another theory before Joan helps them schedule observations for the rest of the day and some to go on the Internet to seek answers to their questions.

Throughout, most of the children write down their observations and hypotheses, as Joan points out, so they don't forget. She also points out that as scientists the difficult part is not getting so engrossed that you forget to keep notes. She adds, "It's so easy to talk about it and not write it

down, and yet a scientist would be writing it all down because he'd want to have evidence and come back and think about it."

Along the way, the students have given directions to Joan as to which ducks to put together in which circumstances, controlling selected variables to test for covariation.

The pecking issues reemerge when a group of children undertake another study. For homework they have designed an experiment to study the ducklings' preference for water, a question generated from their observations. They prepare the experiment during lunchtime, borrowing a sand-tray from a kindergarten teacher. The large tub space used in the experiment incidentally provides the opportunity to add weight to the territorial hypothesis about the pecking, which the students quickly notice and record as the pecking has stopped.

What achievements are these?

Several literate achievements are apparent to me in these interactions. First, a particular epistemological frame has been established, one which appears to be developmentally ahead of its time. Second, the understandings that might be called "scientific literacy" (though this distinction might not be necessary) are also developmentally advanced. Third, the social side of the literate practices of these children is distinctive and has significance for their participation in democratic living. These three matters are quite intertwined with one another.

Epistemology

What is the theory of knowledge implicit in these conversations? The overall set of interactions implies that knowing (in this case in the discipline of science) involves collaborative construction of meaning, with each student being an active agent in the process of construction. With her opening statement, Joan disabuses the students of the idea that she is the source of knowledge in this domain. By not answering their questions and by inviting their contributions, she asserts the relevance of their experience and observation, and their responsibility to seek answers. She presses this responsibility by assuming that, naturally, people will be interested in

these answers and in forming a committee of "only those who are serious" to find answers at home and on the Internet. In another discussion Joan has had them start by listing their questions or "wonderings" followed by their "surprises." The students have many of both. They are aware that their questions are important and should be taken seriously – they are written down and posted publicly with names attached, followed through on, and engaged by other students.

These students were also comfortable with ambiguity and complexity, keeping questions open. "Maybe it's not that bad – you just don't know." There was an unusual amount of "tentative talk" in which students put out half-formed ideas and possibilities without apparent fear that they would look foolish. They clearly value discussion and take each other's comments and observations seriously. They engage them, supporting, challenging and building them, over an extended period of time. These characteristics are all features of constructive knowers, not of received knowers (Belenky et al., 1986), in spite of the fact that most research on these epistemological stances places this development in late adolescence or some time in adulthood (if at all).

In answer to the question "Who am I as a knower?" we have evidence from which to surmise their choice of identity. Consider the fact that these children have become able to formulate and pursue a research problem – a competence that Kuhn and her colleagues (Kuhn, Garcia-Mila, Zohar, & Anderson, 1995) have shown to be slow to develop in many adults. The students thought through the study for homework, committing their ideas to paper, and prepared it in their lunch hour, suggesting personal commitment to knowledge production and a sense of agency in the matter. The relevant conversation was pursued for three days on and off by the children, accompanied by persistent observation, record-keeping, and generation of numerous hypotheses. The nature of these students' participation fits what Wells and Chang-Wells (1992, p. 99) assert is an important literate function of schooling, bringing "the individual's knowledge, and also the processes by which it is acquired, under conscious monitoring, so that she or he may take active and intentional control over her or his own learning and be able to make connections between knowledge acquired in school and that which is acquired in practical life situations outside the classroom." In this framework, the identity children are building as knowers is evident. They have confidence in the significance of their experience and their questions – confidence enough to respectfully disagree with each other and with the teacher – and they are compelled to seek evidence for their theories.

In answer to the question "what is the relationship between the knower and the known?" Belenky and her colleagues (1986, p. 141) describe the epistemological position of constructed knowers as "the opening of the mind and the heart to embrace the world." The students' talk and their handling of the ducklings suggests that they feel connected to the "objects" of their study. Their theorizing about the ducks' behavior was grounded in human analogies, and I suspect that, along with the extended contact time with the ducklings, these analogies contributed to raising the children's awareness of the ethical nature of science. Indeed, two other conversations explicitly addressed this matter. One was an extensive discussion of whether to dissect the overdue eggs, and if so which ones, given the small, but perhaps estimable possibility, that the inhabitants might still be alive. Joan worked both sides of this balance between the objective stance and the personal stance. In one day she noted "If I were its mother, I would want to get it out of there [where it was being pecked]" and then urged children not to get so caught up in the ducklings that they forgot to write their observations and hypotheses. The other discussion was about the significance of naming the ducklings, particularly in the face of their leaving the classroom at the end of the week. There was the issue of who has the right to name and the question of whether it made sense to name under the circumstances. As Gordon pointed out, "What if we called Joan 'Teacher' and she called us 'Hey you'? It just wouldn't be the same."

Even from a very narrow view of literacy, this epistemological achievement should be regarded as significant. For example, Kardash and Scholes (1996) found that undergraduate students' epistemologies influenced their reading of articles that contained mixed evidence. Students whose epistemologies were more constructivist (as these children were demonstrating) were more likely to write conclusions that reflected the inconclusive nature of the article. However, there is reason to believe that the significance goes well beyond that. Indeed, to the extent that this epistemology becomes part of all literate engagements, including the sense of agency and moral commitment in the construction of knowledge, this is no trivial achievement.

"Scientific Literacy"

To approach the knowledge construction issue from another perspective, consider these students' understandings of "science." According to Kuhn and her colleagues (1995) there are

three interrelated areas of understanding to be developed in science education. First, there is the habit of mind of scientific thinking, with its underlying metacognitive and metastrategic aspects. Second, there is the understanding of the concrete practice of doing science – how people put together and negotiate scientific understandings, including how personal and social issues play a role, for example, in deciding what counts as evidence. Third, there is the understanding of the larger social and cultural context in which science is done, and the ways in which science impacts society. In these terms, these students reveal a remarkable grasp of the necessities of scientists. To begin with, they collaboratively and extensively explored the "pecking" problem, generating and selecting theories to test, and selecting the means and evidence of the testing. They have, I believe, a sense that this is how knowledge is pursued, and that the collaborative part of it is fundamental. The theories and "facts" of science have to be engaged in public debate (Kuhn et al., 1995). Normal scientific inquiry involves theorizing and testing, usually, multiple theories. Groups of scientists engage in a process of debate as they articulate theory and evidence, much as lawyers act as advocates. This social process becomes internalized so that scientists are constantly aware of audience concerns and logic.

These students are also aware that data and theory are separate and that their theories need justification through data. They also have an idea of what sort of evidence would distinguish among their theories – concepts not normally developed in this age-group and often not in adults. Certainly graduate students (and often their mentors) still wrestle with these matters. Furthermore, these students are becoming competent at seeking disconfirming evidence. As babies we are very good at theorizing about the world and confirming our theories. We are not particularly good at attending to disconfirming evidence. As a counter to this, Joan asks the children to notice questions and surprises. Surprises, in particular, are places where current taken-for-granted theories are questioned. She highlights the significance of this by commenting "Based on what I'm learning here [in the text and the discussion], what I always believed to be true is not true." At the same time, she demonstrates keeping questions open, and potentially revising her knowledge, but she is also keeping track of the sources of her knowledge. By tuning the students' attention to the feeling of surprise, Joan builds an executive self-correction system.

It is also intriguing that most of the hypotheses were generated by the children "stepping into the ducklings," just as they did when trying to understand a piece of literature – a connection

explicitly made on one occasion by Aja, and later by Joan. The strategy turned up a lot in their literature studies, but in both domains it represents a particularly valuable strategic use of language. As Matthews (1984, p. 67) points out, "an imaginative use of examples is one of the most important techniques for making progress in an abstract discussion" (whether or not it is written down) as might occur in philosophy, ethics, the practice of common law, science and most other disciplines. Some might protest that personification of animals is not really appropriate in science, where objectivity is important. Yet such analogical reasoning has a prominent place in the thinking of expert scientists (Clement, 1991). It expands the problem-space, and is a powerful way of modifying or developing entirely new problem representations. Indeed, Tweney (1991) argues that without it Faraday would have remained a bottle-washer in Sir Humphry Davey's laboratory.

I am compelled that these students are being well prepared to be scientists, but equally well to be citizens – to participate actively in the collaborative decision-making of a democracy. Although they sometimes looked to the teacher as recorder (or perhaps the chart as record), they usually looked at relevant peers during the discussion. Joan often added comments like "I love the way you're really listening to one another," and on the rare occasions they did not, Joan pointed out that they needed to do so. In the process of this conversation, the students supported and disagreed with each other respectfully – a feature sometimes regrettably missing from current scientific debates.

Driver and her colleagues (1996) argue that children need this understanding of the nature of science – knowledge about the production of knowledge – for several reasons. Aside from blunt economic survival of both individual and society, they point to the need to appreciate it to preserve and advance the culture. More interesting, however, is the argument that understanding the nature of science has been found to improve conceptual learning of scientific topics. Further, they argue that in order to participate actively in the democratic decision-making process, citizens must understand the nature of science and of knowledge, particularly the socioscientific issues. Even reading the newspaper is complicated without this knowledge. Finally, they argue that there are commonalities between everyday scientific thinking and moral/ethical judgment in science and the scientific community.

In other words, we cannot simply argue that a scientific habit of mind is an optional extra. It does not seem possible to read or write science without it. But, more importantly, it is part of the

very fabric of activity in a literate democracy. For example, every citizen is required to perform jury service, and judicial reasoning "is an informal, individualized process of approximating truth and reasonableness" (Lawrence, 1991, p. 61) – commonly in a print context. As with science, it requires us to disentangle our emotional and logical sensibilities, without denying the one or the other. The idea is to develop the competence to productively engage feeling with reason to solve problems in emotionally charged social circumstances. To make this a "literate" achievement in the narrower sense of literacy, this competence is developed also through discussions around literature, where students learn to recognize their own and others' feelings and motives, and the evidence, or sources of authority, necessary to distinguish one from the other. This is a necessary part of learning to untangle (not separate) them.

Social Literacy

In the conversation I reported, spread over several days, children have attended to each others' ideas and used them for intellectual leverage. These students are developing strategies for managing social resources, and this ability does not "just happen." For example, in our study we found students classified as very capable who found collaborative literate activities difficult (though one reported that her goal was to change this). Some did not yet value the experiences of others as sources of learning. In this classroom, though, children are learning a way of thinking about and engaging others in mutual understanding (not identical understanding) – developing intersubjectivity. In particular, they are learning to value each other as resources to scaffold their own thinking. Their experience in these engagements is one of expanded intellect, again with the attendant emotional ties. Joan often spent time helping children transform their concerns into "big questions," which are ones that a range of people can become involved in contributing to. These questions are a means for recruiting the social resources to expand the intellectual capacity brought to bear on a problem.

Our field notes and interviews revealed important behaviors based on children's knowledge of one another, such as knowing the reading and writing interests and foibles of others in the class. Through their discussion of books, students were developing a deeper understanding of each other. This is the basis of the social commitment necessary to fuel a democracy, and for the social

imagination necessary for everything from persuasive writing to convincing character creation. In our interviews we asked them about books they had read and who else would be interested in those books and why. In some classrooms, children figured into their recommendations a knowledge of both other children's predilections, and of their ability. At the same time as being clearly aware of one another's relative competence, they did not see its significance as an issue of power but of managing relevant contributions. Furthermore, in classes like Joan's, where children were often involved in forming and managing committees to accomplish particular literate projects such as accounting, book discussion groups, and research, they were often able to talk about the nature of the group process and where it was breaking down. This form of analysis is necessary for collaborative group efforts to be effective and is highly valued in all spheres of life outside of school (Johnson & Johnson, 1989).

Another way of viewing this social side of literacy is as distributed intelligence and the scaffolding of thought. In the many discussions I witnessed, the ability to participate in lots of tentative talk (something many adults do with difficulty) seemed important not only for its epistemological significance, but also because it is necessary for the collaborative problem-solving found in business enterprises and in participatory democracy. The openness of discussion maximizes the possibilities of distributed cognition – the system of collective thought in which the whole is more than the sum of the parts (Salomon, 1993). This distributed thinking is not simply the context for literate thinking, but a kind of literate thinking in itself (Resnick, 1991). In addition, it provides the scaffold for the development of important aspects of individual literate cognition. In most schools children have all executive learning decisions made for them – what to read, when, what problems to engage in which order, what things to write, and so forth. At some point, the assignments stop and we are somehow surprised at how students fail to transfer their learning to "real life" (Perkins, 1993). In theory, if not in practice, this executive decision-making is at some point passed on to the child through "scaffolding." But even then, the learner is not normally given control of building the scaffold – choosing what to scaffold, when, how, and for what purpose. People do ultimately have to choose their physical and social environments, and the choice will have an impact on their psychological development. In the conversation I described above, children are deciding what to study, how to study it, carrying out the actions and making the decisions in a socially responsible community. This is the collective executive function upon

which children can scaffold their intellectual development. To the extent that they gain control of the organization of such learning environments, they have control of the scaffolding of their own literate development.

Common Threads

In my analysis of this particular classroom, I have stressed the social side of literacy particularly because the social is largely missing from images of literacy, certainly in the United States. Not only do classrooms reflect the isolated individual but also posters intended to encourage reading consistently portray individuals. This individualistic view is enforced by assessment systems that isolate individuals and draw attention only to the achievement of isolated individuals, regardless of what might be accomplished in a social setting. In this context collaborative sense making – the co-construction of meaning – generally draws little interest. Researchers (and teachers) approach literate achievement as if it were something contained in the isolated mind of the individual. But it is becoming increasingly clear that thinking, and hence literate learning, is often best viewed as socially mediated activity which lies as much in the relationships among minds as in any one mind (Rogoff & Toma, 1997; Salomon, 1993). In other words, part of becoming literate is learning how to use others' literate thinking as a tool to extend both individual and collective literate thought. Shared literate thought, then, is not simply a process, or a scaffolding strategy, but an achievement.

There are several ways to consider the significance of this. First, outside of school, collaborative problem solving through literate engagements is common. Second, children who are able to engage others' ideas in joint meaning construction are more likely to gain skill and understanding than children whose interactions are not so focused (Light & Glachan, 1994). Third, because individual thinking takes place in the context of social engagement, the individual plays a role in constructing the environment in which his or her thinking develops. The role can be active or passive. Fourth, a democratic society is in some ways predicated on the maximization of distributed intelligence. In other words we might argue, as do those with an interest in "metacognition," that the collective reflection engendered in these interactions must become internalized. But if we fail to consider the competence of being able to arrange social resources in

this manner with the expectation of expanded collective and individual consciousness, we will be missing the heart of a democratic community and of a democratic individual. We can talk about the characteristics of social commitment and independence of judgment that are necessary for democracy to flourish, but if we simply develop distributed cognition as an optional extra, not integral to children's habits of mind, we will have failed to advance democracy. In other words, there is clearly an argument to be made for counting as a literate achievement a set toward intersubjectivity that helps children learn to develop the collective mind (Crook, 1994). In large part, this set of literacies lies in the kind of epistemology children acquire.

There should be no doubt that such a set will serve children well in literate concerns outside of school, whether civic or economic; however, the civic is critical and often neglected. According to Benjamin Barber (1984), strong democracy "can be defined as politics in the participatory mode where conflict is resolved in the absence of an independent ground through a participatory process of ongoing, proximate self-legislation." Citizenship, according to Barber, "is a dynamic relationship among strangers who are transformed into neighbors, whose commonality derives from expanding consciousness rather than geographical proximity." Furthermore, it seems to me that a just, caring democracy cannot exist without social commitment, collaborative action, and independent judgment. Educating a committed citizenry who will productively engage one another in dialogue, and who feel sufficiently connected to balance the tensions between individual and community (Barber, 1984), means *acquiring literate practices in which they can confront one another respectfully, organize and value collaborative literate experiences, and value their own and others' learning.* We might think of this as maximizing the potential of distributed intelligence. We should certainly ask whether our literate practices in schools embody these requirements. Doing so might have us think differently about social development – about "maturity" – another kind of "achievement." As Pradl (1996, p.18) points out, we might value "mature dependency." Infants, because they are unable to survive without their mothers, determine the immature end of the dependency continuum. At its opposite is not the independence of the rugged individual, but rather the kind of relationship that is possible between friends, lovers, learners, workers, a wife and husband. Each involves a kind of reciprocal dependency that in fact defines maturity (a social concept) as opposed to self-sufficiency (an individual concept).

In thinking about the range of possible literate achievements, I was motivated in part by the possibility that there are subtle tradeoffs that are made by good teachers who teach in different ways. Perhaps we can have our cake and eat it sometimes, but we must investigate the potential trade-offs, which means expanding our thinking about what counts as literate achievement. To some extent our limited views of the possibilities of literate thinking for children are a result of the notions of development and the notions of literacy we have lived within for so long. But unless we arrogantly view our culture as having reached the epitome of civilization, our goal thus being one of mere maintenance, we must approach research on children's literacy development in ways that explore literate development with an eye toward the productive evolution of our society. This means opening ourselves to the possibility of developing in children literacies that many adults have barely glimpsed, but which we see occurring in some children in some situations in some classrooms. It means taking exceptional examples of children's literate competence as concrete examples of more general possibility rather than as exceptionality.

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